

PRELIMINARY REMARKS

Claims 21 to 40 as set forth in Appendix II of this paper are now pending in this case. Claims 33 to 40 have been added as indicated in Appendix I of this paper.

New Claims 33 to 40 correspond to Claims 21 to 26, 29 and 31 with the difference that in accordance with the requirements of new Claim 33 the catalyst consists essentially of the components enumerated as (a) to (d). New Claims 34 to 40 depend from Claim 33 and therefore include the requirement that the catalyst consist essentially of the enumerated components by reference. No new matter has been added.

Claims 21 to 32 stand rejected under 35 U.S.C. §103(a) as being unpatentable in light of the teaching of **Dewdney et al.** in **US 3,986,985** ("Dewdney (I)") or in **US 4,064,172** ("Dewdney (II)") which is a divisional application of **US 3,986,985**<sup>1)</sup>.

**Dewdney et al.** disclose that the presence of magnetite in an iron catalyst which is used for hydrogenating adipodinitrile to hexamethylene diamine increases the formation of DCH impurities<sup>2)</sup>. Accordingly, **Dewdney et al.** teach that the formation of DCH impurities can be reduced if the hydrogenation of adipodinitrile to hexamethylene diamine is conducted in the presence of an iron catalyst which is essentially free of haematite<sup>3)</sup>. The Examiner will note that a similar effect -although attributed to the presence of water- is shown by **Kershaw et al.**'s data in Table 2 (ie. col. 5 of **US 3,696,153**; of record) concerning an iron catalyst (A) and a catalyst (C) which is obtained by activating iron ore occurring naturally in Labrador (ie. col. 6, indicated lines 6 to 10, of **US 3,696,153**). As pointed out by **Dewdney et al.**, the iron ore occurring naturally in Labrador consists principally of haematite<sup>4)</sup>.

**Dewdney et al.** further teach that the iron catalyst is obtained from iron oxide or a mixture of iron oxides, and particularly a Swed-

- 1) In the following, the designation **Dewdney et al.** is used collectively for "**Dewdney (I)**" and "**Dewdney (II)**" unless indicated otherwise.
- 2) Note, for example, col. 5, indicated lines 45 to 49, and the comparative investigations in Examples 1 to 4, col. 6, indicated line 10, to col. 7, indicated line 22, of **US 4,064,172**.
- 3) Ie. col. 2, indicated lines 32 and 33, of **US 4,064,172**.
- 4) Ie. col. 5, indicated lines 45 to 49, of **US 4,064,172**.

ish magnetite ore, without without additions or promoters other than iron oxide or iron<sup>5</sup>).

In determining obviousness of a claimed invention, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification which is necessary to arrive at the claimed subject matter<sup>6</sup>). Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art<sup>7</sup>).

The teaching of *Dewdney et al.* specifically aims at reducing unwanted by-products in the hydrogenation of adipodinitrile to hexamethylene diamine. To a person of ordinary skill in the relevant art who seeks to further reduce the formation of such by-products, *Dewdney et al.*'s statement that the catalyst is preferably obtained from iron or iron oxide without other additions or promoters is therefore of particular significance. In light of the objective underlying *Dewdney et al.*'s teaching, the statement indicates that any such additions or promoters can, at best, not be expected to be helpful when a reduction of unwanted by-products is sought. Accordingly, a person of ordinary skill who is seeking ways or means to further reduce the unwanted by-products would not be motivated by the teaching of *Dewdney et al.* to modify the prior art iron catalyst by including other metals or promoters in any particular amounts, let alone the constituents (b) to (d) of applicants' catalyst in the amounts specified in applicants' claims. The mere fact that a reference can be modified or that references can be combined does not

5) *Ie.* col. 2, indicated lines 54 to 64, of *US 4,064,172*.

6) *In re Linter*, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

7) *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (CAFC 2000); see also *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (CAFC 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (CAFC 1992).

render the resulting modification or combination obvious unless the prior art also suggests the desirability of the combination<sup>8)</sup>.

Furthermore, in determining whether a claimed invention would have been obvious under 35 U.S.C. 103, the invention has to be considered as a whole. The invention as a whole referenced in Section 103 is not limited to the subject matter which is literally recited in the claims but also includes properties of the subject matter which are inherent in the particular combination of requirements set forth in the claims and are disclosed in the specification<sup>9)</sup>. To establish that a claimed invention was prima facie obvious under Section 103, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings to arrive at the claimed invention. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant's disclosure<sup>10)</sup>. When the teachings of *Dewdney et al.* are viewed from the standpoint of a person of ordinary skill without the knowledge of applicants' invention, there is nothing which would motivate said person to modify *Dewdney et al.*'s iron catalyst by way of additions or promoters in order to reduce the by-products. Accordingly, the teachings of *Dewdney et al.* fail to meet the first of the three criteria for establishing that applicants' catalyst composition was obvious under the provisions of Section 103(a).

The Examiner has taken the position that applicants' previous argument that neither one of the teachings of *Dewdney et al.* suggests the addition of manganese is unpersuasive because "applicants' claims recite a hydrogenation catalyst which comprises components (a) to

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8) *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (CAFC 1990); see also *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (CAFC 1992).

9) *In re Antonie*, 559 F.2d 618, 620, 195 USPQ 6, 8 (CCPA 1977); see also *In re Papesch*, 315 F.2d 381, 391, 137 USPQ 43, 51 (CCPA 1963) ("From the standpoint of patent law, a compound and all its properties are inseparable."). Obviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established. *In re Rijckaert*, 9 F.2d 1531, 28 USPQ2d 1955 (CAFC 1993).

10) *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (CAFC 1991).

(d). "Comprising" is an open-ended word. It permits the inclusion of unrecited elements." It is respectfully noted that while the transitional phrase "comprising" allows that applicants' composition contains other components than the ones recited in the independent claims, it does not allow for the omission of one of those components. The presence of manganese in amounts of from 0.001 to 1% by weight based on the iron component (a) in applicants' catalyst is mandatory. The question under Section 103(a) is not whether applicants' claims allow for additional unspecified constituents of the catalyst but whether the teachings of *Dewdney et al.* suggest or imply applicants' invention as a whole including each of the mandatory constituents such as the manganese component (d) of applicants' catalyst in the requisite ratios. To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. All words in a claim must be considered in judging the patentability of that claim against the prior art<sup>11</sup>). The Examiner's position is therefore not deemed to be well taken. Favorable reconsideration and withdrawal of the Examiner's rejection under 35 U.S.C. §103(a) to the extent that it is based on the teachings of *Dewdney et al.* is respectfully solicited.

Claims 21 to 32 also stand rejected under 35 U.S.C. §103(a) as being unpatentable in light of the teaching of *Flick et al.* in *US 5,527,946*. The Examiner contends that *Flick et al.* and the teachings of *Dewdney et al.* suggest similar results of a hydrogenation catalyst with similar ratios of components (a) to (d) for the production of nitriles. It is respectfully noted that the teaching of *Flick et al.* relates to a hydrogenation of dinitriles to aminonitriles, ie. a "partial" hydrogenation, whereas the disclosure of *Dewdney et al.* as well as applicants' invention relate to the hydrogenation of dinitriles to diamines, ie. a "complete" hydrogenation. It is well known in the art that the partial hydrogenation of dinitriles to aminonitriles followed by isolating the aminonitriles and subsequently hydrogenating the aminonitrile to the diamine is conducted to limit the formation of detrimental by-products in the preparation of the diamines. This is, for example, corroborated by the statement of *Ebel et al.*

The adiponitrile [sic, aminocapronitrile] obtained by the [partial

11) *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); *In re Wilson*, 424 F.2d 1382, 165 USPQ 494 (CCPA 1970).

hydrogenation] process according to the invention can be used anew for the partial hydrogenation of hexamethylenediamine and 6-aminocapronitrile, avoiding an increase in the level of by-products which prevent the preparation of hexamethylenediamine and/or 6-aminocapronitrile complying with specifications and/or have an adverse effect on the useful life of the catalyst for the partial hydrogenation.

(ie. col. 7, indicated lines 28 to 36, of US 6,222,059<sup>12</sup>); copy enclosed). Accordingly, the catalyst utilized by **Flick et al.** in the first partial hydrogenation is not particularly adapted to avoid unwanted by-products which occur when a complete hydrogenation is conducted. Rather, the teaching of **Flick et al.** conveys that a contamination of hexamethylene diamine with unwanted by-products is reduced by converting dinitriles to diamines in two separate partial hydrogenation reactions wherein the by-products which are formed in the first partial hydrogenation which is addressed by **Flick et al.**'s disclosure are separated from the aminonitrile prior to the hydrogenation of the aminonitrile to obtain the diamine. Moreover, the teaching of **Flick et al.** aims at catalysts which are suitable for preparing aminonitriles from dinitriles which are improved with respect to their life and which provide aminonitriles in good selectivities with only small amounts of hexamethylenediamine<sup>13</sup>). The Examiner's position that **Flick et al.** and **Dewdney et al.** suggest similar results of a hydrogenation catalyst with similar ratios of components (a) to (d) is therefore not deemed to be well taken. The teaching of **Flick et al.** is clearly not concerned with a catalyst which is suitable to limit or reduce the formation of unwanted by-products in a complete reduction of, for example, adipodinitrile to hexamethylene diamine.

A person of ordinary skill in the relevant art who seeks to reduce the formation of by-products in the complete reduction of dinitriles finds nothing in the teaching of **Flick et al.** which would suggest or imply that any modification of **Flick et al.**'s process and/or catalyst can be used to achieve the goal. It is respectfully noted in this context that the partial hydrogenation process which is disclosed by **Flick et al.** was, at the time applicants' made their invention, not considered to solve the problems incurred with the formation of unwanted by-products. This is, for example, corroborated by **Ebel et al.**'s reflection

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12) US 6,222,059 corresponds to WO 98/11059 which is of record.

13) Ie. col. 4, indicated lines 36 to 43, of US 5,527,946.

The disadvantage of this process<sup>14)</sup> is the formation of by-products which can be separated only with great difficulty from the alpha,omega-amino nitriles, such as 6-aminocapronitrile or, where appropriate, other required products, such as adiponitrile and hexamethylenediamine in the case of 6-aminocapronitrile as alpha,omega-amino nitrile.

(ie. col. 1, indicated lines 38 to 44, of US 6,222,059). A teaching, suggestion, or motivation to modify the catalyst of *Flick et al.* in the specific manner which is necessary to arrive at applicants' catalyst in order to obviate the problems incurred in the formation of by-products in the complete hydrogenation is clearly neither explicitly or implicitly in the reference itself nor is it in the knowledge generally available to one of ordinary skill in the art. Rather, the knowledge generally available in the art, as corroborated by the statements of *Ebel et al.* referenced above, indicates that the amount of by-products increases when a catalyst which is adapted for a partial hydrogenation process is used in the complete hydrogenation of, for example, adipodinitrile to hexamethylene diamine.

In light of the knowledge which was available in the relevant art at the time applicants made their invention, ie.

- that the catalyst disclosed by *Flick et al.* for the partial hydrogenation has the disadvantage that unwanted by-products are formed, and
- that the amount of unwanted by-products increases when the hydrogenation is conducted completely rather than partially,

a person of ordinary skill could clearly not consider the catalyst disclosed by *Flick et al.* as a starting point for developing a catalyst which is suitable for a complete hydrogenation and particularly a catalyst which avoids increased amounts of contaminating by-products. When the teaching of *Flick et al.* is considered as a whole for what it reasonably conveyed to a person of ordinary skill in the pertinent art at the time applicants' made their invention, it clearly falls short from rendering applicants' invention as a whole obvious under Section 103(a). Favorable reconsideration of the Examiner's position and withdrawal of the respective rejection is therefore respectfully solicited.

14) The referenced process is the one disclosed in DE 44 468 93 which is the German counterpart application of *Flick et al.*'s US 5,527,946, as evidences by the foreign application priority data set forth on the cover page of US 5,527,946.

REQUEST FOR EXTENSION OF TIME:

It is respectfully requested that a three month extension of time be granted in this case. A check for the \$920.00 fee is attached.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees to Deposit Account No. 11.0345. Please credit any excess fees to such deposit account.

Respectfully submitted,

KEIL & WEINKAUF



Herbert B. Keil

Reg. No. 18,967

1350 Connecticut Ave, N.W.  
Washington, D.C. 20036  
(202) 659-0100

Encl.: THE CHANGES IN THE CLAIMS (Appendix I)  
THE AMENDED CLAIMS (Appendix II)  
Ebel et al. (US 6,222,059)

HBK/BAS

## A P P E N D I X I:

THE CHANGES IN THE CLAIMS (version with markings, showing the changes made):

New Claims 33 to 40 have been added.

- C1
33. (new) A hydrogenation catalyst consisting essentially of
    - (a) iron or a compound based on iron or a mixture thereof,
    - (b) from 0.001 to 0.3% by weight based on (a) of a promoter based on 2, 3, 4 or 5 elements selected from the group consisting of aluminum, silicon, zirconium, titanium and vanadium,
    - (c) from 0 to 0.3% by weight based on (a) of a compound based on an alkali and/or alkaline earth metal, and
    - (d) from 0.001 to 1% by weight based on (a) of manganese.
  34. (new) The catalyst defined in claim 33, which is obtained by reduction with or without subsequent passivation of a magnetite.
  35. (new) The catalyst defined in claim 33, which is obtained by precipitating precursors of said components (a), (b), (d) and optionally (c) in the presence or absence of support materials.
  36. (new) The catalyst defined in claim 33, which is obtained by impregnating a support with a solution of said components (a), (b), (d) and optionally (c).
  37. (new) The catalyst defined in claim 33, which is obtained by spraying said components (a), (b), (d) and optionally (c) onto a support.
  38. (new) The catalyst defined in claim 33, which has a BET surface area of from 3 to 20 m<sup>2</sup>/g, a total pore volume of from 0.05 to 0.2 mL/g, an average pore diameter of from 0.03 to 0.1 μm and a 0.01 to 0.1 μm pore volume fraction within the range from 50 to 70%.
  39. (new) The catalyst defined in claim 33, wherein component (c) is present in an amount of from 0.01 to 0.2% by weight based on (a).
  40. (new) The catalyst defined in claim 33, wherein component (d) is present in an amount of from 0.001 to 0.3% by weight based on (a).
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